

*** NOTICES ***

JPO and INPIT are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]**[0001]**

[Field of the Invention] In this invention, it irradiates with ultraviolet rays, after applying ultraviolet curing resin with a spin coat method on a disk.

Therefore, it is related with the optical recording medium with which it comes to form the protective layer or light transmission layer which consists of the manufacturing installation of an optical recording medium which stiffens the ultraviolet curing nature resin concerned, a manufacturing method, and such ultraviolet curing resin.

[0002]

[Description of the Prior Art] As an optical disc to which record reproduction of information is performed by the exposure of a laser beam, a magneto-optical disc, various write once optical disks, the digital audio disc (compact disk), the optical video disk (laser disc (registered trademark)), etc. are put in practical use. Each of these optical discs is considered as the composition for which functional membrane, such as record film and a reflection film, was formed as a signal recording layer on the transparent substrate which consists of plastic material or glass, such as polycarbonate.

[0003] Such an optical disc like a compact disk (CD) and a laser disc like the ROM (Read Only Memory) mold disk only for playback, and a magneto-optical disc, Arbitrary information is recorded and it is roughly classified into the RAM (Random Access Memory) type disk in which playback, a postscript, rewriting, etc. are possible if needed.

[0004] In a ROM type disk, concavo-convex prepit is formed on a transparent substrate at about 1/4 wave of depth of regenerated light, the reflection film is formed so that an it top may be covered, and playback of information is performed by detecting the reflectance change by interference of the light produced in prepit.

[0005] On the other hand, in the case of the phase change type disk provided with the signal recording

layer which consists of phase change materials, for example, by making a signal recording layer produce a phase change according to recorded information, record or elimination of information is performed and playback of information is performed by detecting the reflectance change of the light accompanying it in a RAM type disk. Irradiating with the laser beam condensed by the signal recording layer in the case of the magneto-optical disc provided with the signal recording layer which consists of magnetic materials. By impressing the external magnetic field which used the magnetic head for the portion locally heated more than Curie temperature, and was modulated according to recorded information, record or elimination of information is performed and reproduction of information is performed by detecting the reflectance change of the light according to the magnetizing direction by the car (Kerr) effect.

[0006]By the way, development of the digital versatile disc (DVD) which can store one movie is advanced to the disk with a same diameter [as CD] of 120 mm by about the same image quality as the present television these days. In this DVD, storage capacity is raised up to six to 8 times of CD, and laser with a shorter than 780 nm wavelength of 635 nm - 650 nm which is the wavelength of the present laser is used for record reproduction.

[0007]In DVD, the thing of structure which pasted together the 0.6-mm-thick single plate disk of two sheets so that a signal recording layer might serve as the inside is devised. For example, a signal recording layer is formed only in the SD-10 type disk with which the signal recording layer is formed in both disks, and one disk, and the disk of another side has an SD-5 type disk used as the dummy disk in which the signal recording layer is not formed in the ROM type disk only for playback. Similarly, there are that by which the signal recording layer is formed in both disks, and a thing by which the signal recording layer is formed only in disk of one of the two also in the RAM type disk which can be written in.

[0008]As mentioned above, plastic material other than glass, such as polycarbonate, an acrylic, and an epoxy resin, is used for the optical disc as a transparent substrate. Since it excels in a moldability, dimensional stability, low absorptivity, etc. also in it, polycarbonate is used most.

[0009]Generally to the lamination of these disks, hot melt adhesive, UV cure adhesive, thermosetting adhesive, etc. are used and these adhesives The roll coat method and a spin coat method, It forms as a glue line on the lamination side of a disk by a silk-screen-printing method etc., or a double-sided adhesion sheet is stuck on the lamination side of a disk, and the method of pasting these disks together is used.

[0010]

[Problem(s) to be Solved by the Invention]By the way, in an optical disc which was mentioned above, as shown in drawing 10, the protective layer 101 is formed in the lamination side side of the disk 100. On the field in which the signal recording layer 103 of the disc substrate 102 was formed, after applying ultraviolet curing resin with a spin coat method, for example, this protective layer 101 irradiates with ultraviolet rays, and is formed by stiffening this ultraviolet curing resin.

[0011]When forming this protective layer 101 concretely, while only predetermined time rotates the disk 100, for example at 4500 rpm, ultraviolet curing resin of the specified quantity is dropped at the inner periphery of this disk 100. Thereby, ultraviolet curing resin is extended to a peripheral part, and a coat is formed all over the disk 100. And after stopping and carrying out 2-3 second passage of the rotation of the disk 100, only predetermined time irradiates with ultraviolet rays to the disk 100 with which this coat was formed, and this ultraviolet curing type resin is stiffened. By this, the protective layer 101 will be formed on the field in which the signal recording layer 103 of the disc substrate 102 was formed.

[0012]However, since the climax portion 101a of the protective layer 101 as shown in drawing 10 will be formed in the outer periphery part of the disk 100 if the protective layer 101 is formed with the conventional technique mentioned above, When lamination of these disks was performed, this climax 101a portion interfered and there was a problem that the disk 100 will be stuck unevenly.

[0013]It is thought that the climax portion 101a of this protective layer 101 is formed as follows. Namely, when ultraviolet curing resin is dropped at the inner periphery of the disk 100 by the spin coat method mentioned above, rotating the disk 100, this ultraviolet curing resin, It is applied all over this disk 100, being extended by the centrifugal force to the peripheral part of the disk 100, and being shaken off in the outer periphery part of the disk 100. Climax of ultraviolet curing resin is formed in the outer periphery part of the disk 100 at this time. If climax of this ultraviolet curing resin stops and neglects rotation of a disk, although it will flow to the inner circumference side of the disk 100 gradually, with the viscosity of this ultraviolet curing resin, and surface tension, thoroughly, flatness does not become but becomes having risen with as in the outer periphery part of the disk 100. And when ultraviolet rays are irradiated, ultraviolet curing resin will be hardened and the climax portion 101a of the protective layer 101 which was mentioned above will be formed in the outer periphery part of the disk 100.

[0014]Although the climax portion 101a of this protective layer 101 changes also with the viscosity of ultraviolet curing resin, and surface tension, it will usually be formed by a width of about 1-2 mm, and that amount of climaxes will be about 2 to 3 times the average thickness.

[0015]For this reason, in the lamination optical disc mentioned above, when the climax portion 101a of the protective layer 101 became large too much, there was a problem of high modification of frequency arising, causing aggravation of focal acceleration, etc., and as a result causing sharp deterioration of quality.

[0016]Then, this invention is proposed in view of such a conventional situation, and is a thing. The purpose is to provide the manufacturing installation and manufacturing method of the optical recording medium which prevented climax of ultraviolet curing resin from being formed in an outer periphery part.

And it aims at providing the optical recording medium with which it comes to form the protective layer or light transmission layer which consists of such ultraviolet curing resin.

[0017]

[Means for Solving the Problem] In a manufacturing installation of an optical recording medium concerning this invention which attains this purpose. A rotary part which rotates a disk with which ultraviolet curing resin was applied, and a light source which is provided above a disk and irradiates with ultraviolet rays to the disk concerned, It is contacted by outer periphery part of a disk and has a wrap light shielding mask for an approximate circle annular peripheral ring which forms the principal surface of the disk concerned, and the continuous principal surface, and the circumference of a disk with which ultraviolet rays are irradiated.

[0018] While a disk with which an approximate circle annular peripheral ring was contacted by outer periphery part of a disk, and this peripheral ring was contacted in this manufacturing installation after the principal surface of the disk concerned and the continuous principal surface were formed rotates by a rotary part, By applying ultraviolet curing resin, a coat is formed on the principal surface of the disk concerned, and the continuous principal surface. And only ultraviolet curing resin on the principal surface of the disk concerned can be stiffened by irradiating ultraviolet rays with a light source, covering the circumference of a disk with which this coat was formed with a light shielding mask. Thereby, it can prevent carrying out climax formation of ultraviolet curing resin to an outer periphery part of a disk.

[0019] This invention is characterized by a manufacturing method of an optical recording medium comprising the following.

A process of making an approximate circle annular peripheral ring contacting an outer periphery part of a disk, and forming the principal surface of the disk concerned, and the continuous principal surface.

A process of forming a coat on the principal surface of the disk concerned, and the continuous principal surface by applying ultraviolet curing resin while rotating a disk with which a peripheral ring was contacted.

A process which stiffens only ultraviolet curing resin on the principal surface of the disk concerned by irradiating with ultraviolet rays while covering the circumference of a disk with which a coat was formed with a light shielding mask.

[0020] Rotating [make an approximate circle annular peripheral ring contact an outer periphery part of a disk, and] a disk with which this peripheral ring was contacted in this manufacturing method, after forming the principal surface of the disk concerned, and the continuous principal surface. By applying ultraviolet curing resin, a coat is formed on the principal surface of the disk concerned, and the continuous principal surface. And only ultraviolet curing resin on the principal surface of the disk concerned can be stiffened by irradiating with ultraviolet rays, covering the circumference of a disk with which this coat was formed with a light shielding mask. Thereby, it can prevent carrying out climax formation of ultraviolet curing resin to an outer periphery part of a disk.

[0021]A peripheral ring approximate circle annular to an outer periphery part of a disk in an optical recording medium concerning this invention is contacted, By a disk with which this peripheral ring was contacted rotating, and applying ultraviolet curing resin, after the principal surface of the disk concerned and the continuous principal surface are formed, It comes to form a protective layer or a light transmission layer which consists of ultraviolet curing resin on the principal surface of the disk concerned by irradiating ultraviolet rays, covering the circumference of a disk with which a coat was formed on the principal surface of the disk concerned, and the continuous principal surface, and this coat was formed with a light shielding mask.

[0022]In this optical recording medium, in an outer periphery part of a disk, since there is no climax of a protective layer or a light transmission layer, when these disks are pasted together, it can paste together uniformly.

[0023]

[Embodiment of the Invention]Hereafter, an embodiment of the invention is described in detail with reference to drawings.

[0024]First, the optical recording medium produced with the application of this invention is explained.

[0025]The 1st disk 5 with which this optical recording medium is the optical disc 1 of the shape of an approximate circle board which has a feed hole in the central part as shown in drawing 1, and it comes to laminate the signal recording layer 3a and the protective layer 4a on the 1 principal surface of the disc substrate 2a one by one, It has composition which the 2nd disk 6 which it comes to laminate the signal recording layer 3b and the protective layer 4b one by one makes the mutual protective layers 4a and 4b counter, and was stuck via the glue lines 7a and 7b on the 1 principal surface of disc substrate 2b.

[0026]The disc substrate 2a and 2b are the transparent substrates in which the material which has a light transmittance state was formed in the shape of an approximate circle board, and plastic material other than glass, such as polycarbonate (PC), polymethacrylate (PMMA), an acrylic, and an epoxy resin, is used as the material, for example. Also in it, it is desirable to use polycarbonate from viewpoints of moldability, dimensional stability, low water absorption property, etc.

[0027]The signal recording layers 3a and 3b, for example In the case of the ROM type disk only for playback. Concavo-convex prepit is formed on the transparent substrate mentioned above at about 1/4 wave of depth of regenerated light, for example by 19-60-nm thickness, a reflection film is formed by vacuum film formation art, and aluminum, Au, Pt, Cu, etc. become by it so that an it top may be covered. And in this ROM type disk, when the irradiated laser beam is reflected with a reflection film, playback of information is performed by detecting the reflectance change by interference of the light produced in prepit.

[0028]The 1st transparent dielectric film in which the signal recording layers 3a and 3b consist of SiN (s) etc., for example in the case of a magneto-optical disc, The magnetic record film which consists of magnetic materials, such as TbFeCo, the 2nd transparent dielectric film that consists of SiN(s) etc.,

and the reflection film which consists of aluminum etc. consist of four layer systems laminated by this order by sputtering etc. And, irradiating with the laser beam condensed by the signal recording layers 3a and 3b in this magneto-optical disc. By impressing the external magnetic field which used the magnetic head for the portion locally heated more than Curie temperature, and was modulated according to recorded information, record or elimination of information is performed and reproduction of information is performed by detecting the reflectance change of the light according to the magnetizing direction by the car (Kerr) effect.

[0029]The 1st transparent dielectric film in which the signal recording layers 3a and 3b consist of ZnS-SiO₂ etc., for example in the case of a phase change type disk, The phase change record film which consists of phase change materials, such as GeSbTe, the 2nd transparent dielectric film that consists of ZnS-SiO₂ etc., and the reflection film which consists of aluminum etc. consist of four layer systems laminated by this order by sputtering etc. And, irradiating with the laser beam condensed by the signal recording layers 3a and 3b in this phase change type disk. By producing a phase change called an amorphous state from a crystallized state, record or elimination of information is performed and reproduction of information is performed by detecting the reflectance change of the light accompanying it.

[0030]A dielectric film is for planning the enhancing effect of antioxidizing of magnetic record film or phase change record film, and the magneto optical signal by multiple interference.

[0031]As for the signal recording layers 3a and 3b, in the case of the added type disk of a postscript, sputtering etc. come to laminate organic dye films, such as a cyanine system or a phthalocyanine system, and the reflection film which consists of Au, aluminum, etc. at this order, for example. And by forming a recording mark in the position with which the laser beam was irradiated with by the signal recording layers 3a and 3b by record power, and this laser beam was irradiated in the added type disk of a postscript, Record of information is performed, a laser beam is irradiated by reproduction power by the signal recording layers 3a and 3b in which the recording mark was formed, and reproduction of information is performed by detecting the reflectance change of the returned light according to the existence of the recording mark.

[0032]The protective layers 4a and 4b are for protecting the signal recording layers 3a and 3b, respectively, for example, consist of ultraviolet curing type resin etc.

[0033]The glue lines 7a and 7b consist of hot melt adhesive, UV cure adhesive, thermosetting adhesive, radical system adhesives, cation system adhesives, etc., for example. The method of carrying out thin film forming on the lamination side of the disks 5 and 6 like the roll coat method, or a spin coat method and the silk screen method as a formation method of this glue line 7, the method of sticking a double-sided adhesion sheet on the lamination side of the disks 5 and 6, etc. can be mentioned. The glue lines 7a and 7b should just be the composition formed on the lamination side of at least one disk among the 1st disk 5 and the 2nd disk 6.

[0034]The optical disc 1 produced with the application of this invention is not necessarily limited to

what was stuck so that the mutual signal recording layers 3a and 3b might serve as the inside in the disks 5 and 6 of two sheets mentioned above. For example, a signal recording layer is formed only in one disk, and what is a dummy disk in which the signal recording layer is not formed, and the disk of two or more more sheets stick the disk of another side, and it may come to unite it.

[0035]The optical disc 1 produced with the application of this invention may be a single plate disk with which it comes to laminate the signal recording layer 3 and the protective layer 4 on the 1 principal surface of the disc substrate 2 as not necessarily limited to a lamination disk which was mentioned above and shown in drawing 2 one by one.

[0036]The optical disc 1 may be the composition that it is considered as the light transmission layer 4 instead of the protective layer 4, and a laser beam is irradiated from this light transmission layer 4 side to the signal recording layer 3. In this case, what carried out the grinding process of a glass plate, a ceramic plate, a silicon wafer, etc. can be used as the disc substrate 2.

[0037]From being formed by the same material as the protective layer 4, and the same technique, by the following explanation, for convenience, the light transmission layer 4 shall summarize these as the protective layer 4, and shall treat them.

[0038]In the above optical discs 1, on the field in which the signal recording layer 3 of the disc substrate 2 was formed, after applying ultraviolet curing resin with a spin coat method, for example, the protective layer 4 irradiates with ultraviolet rays, and is formed by stiffening this ultraviolet curing resin.

[0039]The protective layer 4 is formed by using the manufacturing installation of the optical disc 1 which specifically applied this invention as shown in drawing 3 and drawing 4. Drawing 3 is an outline side view showing the composition of this manufacturing installation, and drawing 4 is an outline top view showing the composition of this manufacturing installation. Only let the thing of the disc substrate 2 in which the signal recording layer 3 was formed be the disk 10 in the following explanation.

[0040]This manufacturing installation is provided with the following.

Rotary part 11.

Ultraviolet irradiation lamp 12.

Peripheral ring 13.

Light shielding mask 14.

[0041]The rotary part 11 is provided with the following.

The turntable 15 on which the disk 10 is laid.

The spindle motor 16 which rotates the disk 10 laid on this turntable 15 in the direction of drawing 4 Nakaya seal A at predetermined number of rotations.

The boss section 17 protrudes on the center section of the turntable 15, and when the feed hole of the disk 10 fits into this boss section 17, the disk 10 is positioned correctly.

[0042]The ultraviolet irradiation lamp 12 is allocated above the turntable 15, and irradiates with the ultraviolet rays 13 to the principal surface 10a of the disk 10 laid on the turntable 15.

[0043]The peripheral ring 13 presents approximate circle annular, and has the level difference part 18 contacted by the outer periphery part of the disk 10 at the inner periphery made into the inside diameter which was abbreviated-in agreement with the outer diameter of the disk 10.

[0044]Only the thickness of the disk is low formed rather than the principal surface 13a of the peripheral ring 13, and this level difference part 18 is made as [form / the principal surface 13a of the peripheral ring 13 / the principal surface 10a of the disk 10, and the continuous principal surface], when contacted by the outer periphery part of the disk 10.

[0045]The adhesive tape 19 for equipping the outer periphery part of the disk 10 with the peripheral ring 13 is formed in the level difference part 18. This adhesive tape 19 is made into the adhesive power of the grade which does not drop out of the outer periphery part of the disk 10 at the time of rotation, and sticks the level difference part 18 to the lower part side outer periphery part of the disk 10.

[0046]This peripheral ring 13 is caudad arranged rather than the disk 10 laid on the turntable 15, and if thrust up in the direction of drawing 3 Nakaya seal B by two or more pressure-from-below pins 20, it will be stuck to the level difference part 18 in the lower part side outer periphery part of the disk 10. Thereby, the disk 10 is equipped with the peripheral ring 13. On the other hand, by being poked and lowered in the direction of drawing 3 Nakaya seal C by two or more thrust lowering pins 21, the peripheral ring 13 with which the disk 10 was equipped is removed from the disk 10, and is again returned under the disk 10.

[0047]As for the peripheral ring 13, it is desirable to be formed with the material that the principal surface 13a has the same surface tension as the principal surface 10a of the disk 10. The width of the peripheral ring 13 can be arbitrarily set up with viscosity, surface tension, etc. of ultraviolet curing resin which are mentioned later.

[0048]The light shielding mask 14 is presenting the approximate circle annular which is a thing of a wrap sake and was made into the inside diameter which was abbreviated-in agreement with the outer diameter of the disk 10 in the circumference of the disk 10 to which ultraviolet curing resin was applied. The light shielding mask 14 is carried out comparatively for 2 minutes, and is made as [present / the approximate circle annular mentioned above by being contacted mutually].

[0049]This light shielding mask 14 is formed in the peripheral ring 13 with which the disk 10 was equipped, and the approaching height. moreover -- the light shielding mask 14 of each other divided into two is made removable in drawing 3 and the direction of drawing 4 Nakaya seal D -- alienation -- sometimes, It is arranged outside the periphery of the peripheral ring 13, and is contacted in the position which carries out for [of the circumference of the disk 10] relativity to the principal surface 13a of the wrap position 13, i.e., a peripheral ring, at the time of contact.

[0050]As for the light shielding mask 14, it is desirable to be formed with metallic materials, such as

the material which does not make ultraviolet rays penetrate, for example, stainless steel etc., and stainless steel SUS304 is used for it here.

[0051]When forming the protective layer 4 using the manufacturing installation constituted as mentioned above, as shown in drawing 3, the disk 10 is first laid on the turntable 15 of the rotary part 11.

[0052]Next, as shown in drawing 5, the disk 10 laid on the turntable 15 is equipped with the peripheral ring 13. At this time, by two or more pressure-from-below pins 20, the peripheral ring 13 is thrust up in the direction of figure Nakaya seal B, and is stuck to the level difference part 18 in the lower part side outer periphery part of the disk 10. By this, the disk 10 will be equipped with the peripheral ring 13, and the principal surface 13 of this peripheral ring 13 will form the principal surface 10a of the disk 10, and the continuous principal surface.

[0053]Next, as shown in drawing 6, while only predetermined time rotates the disk 10 with which it was equipped with the peripheral ring 13, for example at 4500 rpm with the spindle motor 16, ultraviolet curing resin of the specified quantity is dropped at the inner periphery of this disk. Thereby, ultraviolet curing resin is extended by the centrifugal force to the peripheral part of the disk 10 and the peripheral ring 13, and the coat 22 applied on the continuous principal surface which consists of these disks 10 and the peripheral ring 13 is formed.

[0054]Next, covering the circumference of the disk 10 with the light shielding mask 14, after stopping and carrying out 2-3 second passage of the rotation of the disk 10 with which it was equipped with the peripheral ring 13, as shown in drawing 7 and drawing 8 with the ultraviolet irradiation lamp 12. To the principal surface 10a of the disk 10 in which this coat 22 was formed, only predetermined time irradiates with ultraviolet rays and this coat 22 is stiffened.

[0055]At this time, the light shielding mask 14 divided into two will be contacted in the position which carries out for relativity to the principal surface 13a of the peripheral ring 13, and will cover the circumference of the disk 10. Thereby, it is irradiated with ultraviolet rays by only the principal surface 10a of the disk 10, and only the ultraviolet curing resin applied on this principal surface 10a is stiffened.

[0056]In order for the light shielding mask 14 to prevent ultraviolet rays being irradiated by the coat 22 located directly under this light shielding mask 14, i.e., the ultraviolet curing resin applied on the principal surface 13a of the peripheral ring 13, it is desirable that it is close as much as possible with the peripheral ring 13 with which the disk 10 was equipped.

[0057]Next, as shown in drawing 9, the peripheral ring 13 is removed from the disk 10. At this time, the peripheral ring 13 is poked and lowered in the direction of figure Nakaya seal C from two or more thrust lowering pins 21, and the level difference part 18 is estranged from the outer periphery part of the disk 10.

[0058]Of the above, the protective layer 4 which consists of ultraviolet curing resin is formed on the disk 10, i.e., the field in which the signal recording layer 3 of the disc substrate 2 was formed.

[0059]In this technique, the principal surface 10a of this peripheral ring 13 forms the principal surface 10a of the disk 10, and the continuous principal surface by equipping the outer periphery part of the disk 10 with the approximate circle annular peripheral ring 13.

[0060]For this reason, climax of the ultraviolet curing resin mentioned above when ultraviolet curing resin was applied rotating the disk 10 with which it was equipped with the peripheral ring 13, It will be formed in the outer periphery part of the peripheral ring 13 which forms the principal surface 10a of this disk 10, and the continuous principal surface instead of the outer periphery part of the disk 10.

[0061]Here, although it changes also with the viscosity of ultraviolet curing resin and surface tension which are applied, since climax of ultraviolet curing resin is formed by the width which is about 1-2 mm, it is desirable [the width of the peripheral ring 13] to make it larger than this width.

[0062]Thereby, it can prevent forming climax of ultraviolet curing resin in the outer periphery part of the disk 10.

[0063]And in this technique, covering the circumference of the disk 10 with which ultraviolet curing resin was applied with the light shielding mask 14, it irradiates with ultraviolet rays and only the ultraviolet curing resin applied on the principal surface 10a of this disk 10 is stiffened.

[0064]Thereby, the protective layer 4 made into uniform thickness without climax of ultraviolet curing resin can be formed in the outer periphery part of the disk 10.

[0065]Although the amount of climaxes of the protective layer 101 formed by the conventional technique mentioned above here changes with the viscosity and surface tension of ultraviolet curing type resin, it is about 2 to 3 times of average thickness about. For example, if average thickness shall be 8 micrometers, the amount of climaxes will be set to about 20 micrometers. If average thickness shall be 100 micrometers, for example when it is considered as a light transmission layer instead of a protective layer, the amount of climaxes will be set to about 200-300 micrometers.

[0066]To it, by this technique, as mentioned above, climax of ultraviolet curing resin is not formed on the principal surface 10a of the disk 10, it can continue all over the disk 10 and the protective layer 4 or the light transmission layer 4 of uniform thickness can be formed.

[0067]Therefore, these disks 10 can be pasted together uniformly, making the mutual protective layer 4 counter.

[0068]It becomes possible to manufacture the quality optical disc 1 whose reliability improved as mentioned above.

[0069]

[Effect of the Invention]As explained to details above, according to this invention, when it can prevent forming climax of ultraviolet curing resin in the outer periphery part of a disk and these disks are pasted together, it can paste together uniformly. Therefore, the quality optical recording medium whose reliance improved is producible.

[Translation done.]